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Role of MRI in Postoperative Assessment and Detection of Recurrence in Cancer Rectum

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ABSTRACT

Background: rectal cancer constitutes about one third of all gastrointestinal tumor. High resolution MRI plays a pivotal role in the post-operative follow up and also plays an important role in detection of recurrence. It is the best modality to assess the relations of the rectal tumor and the potential circumferential resection margin (CRM). Therefore it is currently considered the method of choice for local staging of rectal cancer and follows up after total mesorectal excision (TME) and detection of residual or recurrent cancer.

Objective: the purpose of this study was to assess the accuracy of MRI in the postoperative assessment rectal carcinoma and detection of recurrence.

Subjects and methods: twenty patients with pathologically proven rectal carcinoma underwent pelvic MRI examination. **Results:** this study was conducted on twenty patients (13 male and 7 female) who underwent surgical excision of pathologically proven cancer rectum. Patients were selected from outpatient's clinic and Department of Surgery at the El-Demerdash Hospital. The patient's age ranges from 32 to 75 years old.

Conclusion: MRI of rectal cancer was accurate for post-operative assessment and had high sensitivity with specificity in the detection of recurrence.

Keywords: rectal cancer, high resolution magnetic resonance imaging, postoperative assessment, detection of recurrence.

INTRODUCTION

Rectal cancer ranks third amongst the most frequently diagnosed tumors in the world, after lung cancer and breast cancer [(1)]. Operative rectal cancer management has been refined significantly during the past 20 years. The main advance has been the specialization and standardization of mesorectal excision, pathological involvement of the circumferential resection margin (CRM) and/or an incomplete mesorectum excision are predictors of local recurrence [(2)].

Currently, surgical resection with stage appropriate neo-adjuvant combined modality therapy is the mainstay in treatment of rectal cancer. In the past decade, the increasingly widespread adoption of total mesorectal excision (TME) has resulted in a dramatic decline in the prevalence of local recurrence from 38% to less than 10%. TME is a surgical technique that entails en bloc resection of the primary tumor and the mesorectum by means of dissection along the mesorectal fascial plane or the circumferential resection margin (CRM) [(3)].

A study showed that high-resolution MR imaging was a reliable and reproducible technique with high specificity (92%) for predicting a negative CRM, the relationship of the tumor to the CRM and the depth of tumor invasion outside the muscularis propria [(3)].

The presence of tumor at 1 mm or less from the fascia is directly related with local recurrence and a poor survival rate. While, TME cures early stages of the disease, preoperative radiotherapy or chemo-radiotherapy provide tumor size and staging reduction in most extensive disease, increasing the possibility of attaining free margins in surgery [(4)].

High resolution T2-weighted imaging is the key sequence in the magnetic resonance (MR) imaging evaluation of preoperative assessment of primary rectal cancer, this technique allows differentiation between rectal tumors confined within the rectal wall (stage T2 tumors) and those that extend beyond the muscularis propria (stage T3 tumors) [(3)].

Post-operative MRI and diffusion-weighted MRI (DW-MRI) has been reported high accuracy for the diagnosis of locally recurrent rectal cancer as DW-MRI clearly discriminates the abnormal signal intensity of tumor from surrounding organs such as the bowel or from fibrosis [(3)].

Moreover, the benefit of diffusion weighted MRI is to detect small metastatic implants , it also proved to be valuable in the setting of associated sepsis or anastomotic leakage because it may differentiate between recurrence and inflammation on the basis of morphological features on T2 or enhanced T1-weighted MR images [(5)].

MRI examination is based on T2-weighted (w) fast spin echo (FSE) sequences acquired in the sagittal, axial, and coronal planes using a 1.5 Tesla MR unit. Gadolinium-enhanced Fat-suppressed FSE T1-weighted sequences may additionally be performed, as well as diffusion-weighted MR images [(5)].

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AIM OF THE WORK

This study aimed to emphasize the role of MRI in the follow up of postoperative rectal carcinoma to detect any possible recurrence in order to get the highest accuracy in the management of rectal cancer.

PATIENTS AND METHODS

This study was conducted on twenty patients (13 male and 7 female) who underwent surgical excision of pathologically proven cancer rectum. Patients were selected from outpatient's clinic and Department of Surgery at the El-Demerdash Hospital. The patient's age ranged from 32 to 75 years old.

Population of the study and disease condition:

All patients in this study had undergone surgical excision of pathologically proven cancer rectum.

Inclusion Criteria

- All patients had underwent either Anterior Perineal Resection , Low anterior resection or Pelvic exentration of previously diagnosed & Staged cancer rectum by (Colonoscopy , Biopsy and MRI)
- Some patient had received pre-operative Neo-adjuvant therapy ,some received only post-operative adjuvant therapy and some patients received both.
- Specimens obtained at surgery were sent to pathology department for pathological staging.
- Patients under follow up of previously excised cancer rectum are also included.

Exclusion Criteria

Patients with any contra-indications to MRI examination.Patients with:Any electrically, magnetically or mechanically activated Implants: cardiac pacemakers, cochlear implants and hearing Aids.

1) Intacranial aneurysmal clips (unless made of Titaneum).
2) Ferromagnetic surgical clips or Staples.
3) Metalic Foreign Body in the Eye.

Machine Used

- MRI scan was performed on a 1.5 magnet (Achieva, Philips)

Type of coil:

- We used external phased-array surface coil.

Patient position and preparation

- Patients position is supine and they did not need any bowel preparation before examination.

Technique of Examination

- The patient lies in the supine position on the examination couch entering the feet first.
- The pelvic phased array coil was connected and composed of two sections. The upper section of the pelvic array coil was brought up between the patient's legs and visually centered over the lower section of the array. Both sections were marked with align of the marks on both coils.
- Ear bluges were applied for the patient after all instruction had been given.
- When the patient was positioned, the array was secured with straps provided. In addition to holding the arrays sections together, these straps help minimize patient motion artifacts.
- Application of immobilization foam pads.
- Sagittal scout images are obtained parallel to the coil.
- The basic sequence protocols for MR imaging of the rectum is T2-weighted fast spin echo (FSE) sequences acquired in the sagittal, axial, and coronal planes . Gadolinium-enhanced Fat-suppressed FSE T1-weightedsequences are also used in the pelvic MR study to enhance the tissue contrast ,as well as diffusion-weighted MR images are also acquired.

Protocol of MR Imaging

All MRI studies were done on 1.5 T MRI (Achieva, Philips medical system), using body coil (phased_array coil), images acquired with the patient in supine position with head pointing to the magint (HFS). The standard sequences included:

Conventional MRI

- Sagittal T2-weighted turbo spin-echo (TR/TE = 3500/80 ms, field of view = 350×328 mm, matrix size = 320×162, slice thickness = 4.5 mm, intersection gap = 4.5 mm).
- Coronal T2-weighted turbo spin-echo (TR/TE = 8630/115 ms, field of view = 220×220 mm, matrix size = 216×150, slice thickness = 3 mm, intersection gap = 0.3 mm).
- Axial T2-weighted turbo spin-echo (TR/TE = 10055/115 ms, field of view = 340×406 mm, matrix size = 332×299, slice thickness = 3 mm, intersection gap = 0.3 mm).
- Axial T1-weighted turbo spin-echo (TR/TE = 550/24 ms, field of view = 340×406 mm, matrix size = 284×266, slice thickness = 3 mm, intersection gap = 3 mm).

1. DW-MRI

DW-MRI was performed using single-shot spin-echo planar imaging, immediately after the axial T2-weighted imaging and before intravenous contrast injection. It was acquired in free breathing with background body signal suppression (Presaturation inversion recovery fat

suppression) using the following parameters: TR/TE = 1688/64 ms, field of view = 340×340 mm, matrix size = 112×100, slice thickness = 3 mm, intersection gap = 1.5 mm, parallel imaging with sensitivity encoding factor of 2, receiver bandwidth = 1382.5 Hz per pixel. We acquired b values (0,400 and 800 s/mm^2) in the axial plane covering 20 slices to include the entire rectal cancer, using motion-probing gradients in three orthogonal axes. We ensured that the field of view, slice thickness and intersection gap were the same as the anatomical axial T2-weighted imaging to allow image overlay and co-registration.

ADC maps were calculated from DW images that were previously assessed. In the patient group, ADC measurements were executed on reconstructed ADC maps with the largest region of interest (ROI) within the tumor. Equal-sized ROIs (each 5 mm^2) that excluded macroscopic necrotic areas (fluid signal on T2), large vessels and areas with susceptibility artifact caused by air-water interface. The greatest dimension of the tumor was measured. ROIs were set up three times and the average of them was used for each ADC value measurement in the malignant masses and detected pelvic L.Ns (>10 mm in the longitudinal diameter).

Dynamic study

Dynamic study was performed after intravenous bolus injection of 0.1mmol/kg body weight of Gd-DTPA at a rate of 2 ml/s, flushed with 20ml of sterile 0.9% saline solution in the antecubital vein.

- Axial T1-weighted turbo-field-echo contrast-enhanced acquisition (TR/TE = 1632/7 ms, field of view = 340×403 mm, matrix size = 300×301, slice thickness = 3 mm, intersection gap = 3 mm).
- Coronal T1-weighted turbo-field-echo contrast-enhanced acquisition (TR/TE = 1523/ 7 ms, field of view = 220×220 mm, matrix size = 200×160, slice thickness = 3 mm, intersection gap = 3 mm).
- Sagital T1-weighted turbo-field-echo contrast-enhanced acquisition (TR/TE = 906 / 7 ms, field of view = 250×329 mm, matrix size = 228×240, slice thickness = 3.5 mm, intersection gap = 3.5 mm).

MRI Imaging analysis

MR images were analyzed for the following:

- MRI appearance of the tumor:
  - Size of the lesion
  - Signal intensity of the tumor.
  - Enhancement of the tumor.
  - Involvement of other pelvic organs.
  - Presence of infiltrated pelvic or para aortic lymph nodes & the peritoneal or omental deposits or hydronephrosis.
  - Presence of ascites.

The study was approved by the Ethics Board of Ain Shams University.

Statistical analysis

Data were analyzed using Statistical Program for Social Science (SPSS) version 20.0. Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done

- Independent-samples t-test of significance was used when comparing between two means.
- Chi-square (X^2) test of significance was used in order to compare proportions between two qualitative parameters.
- Receiver operating characteristic (ROC curve) analysis was used to find out the overall predictivity of parameter in and to find out the best cut-off value with detection of sensitivity and specificity at this cut-off value.
  - Sensitivity = (true +ve)/ [(true +ve) + (false –ve)].
  - Specificity = (true –ve) / [(true –ve) + (false +ve)].
  - PPV = (true +ve) / [(true +ve) + (false +ve)].
  - NPV = (true –ve)/ [(true –ve) + (false –ve)].
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:
- Probability (P-value)
  - P-value <0.05 was considered significant.
  - P-value <0.001 was considered as highly significant.
  - P-value >0.05 was considered insignificant.

RESULTS

Table 1**:** demographic data distribution of the studied group

Demographic Data	No.	%
Sex		
Female	7	35
Male	13	65
Total	20	100
Age (years)		
Range [Mean±SD]	32-75 [51.5±11.29]	

This table showed that the female were 35%) and male were 65%) of sex and mean age was 51.5±11.29

Table 2:T1 and T2 distribution of the studied group

	No.	%
T1		
Hypo	18	90
Isodense	2	10
T2		
Hyper	5	25
Hypo	13	65
Intermediate	2	10

This table showed that the hypo was 90% and isodense was 10% of T1 and hyper was 25%, hypo was 65%) and intermediate was 10% of T2.

Table 3: dynamic enhancement distribution of the studied group

Dynamic Enhancement	No.	%
Enhancement	7	35
Unenhancement	13	65
Total	20	100

This table showd that the enhancement ws 35% and unenhancement was 65% of dynamic enhancement.

Table 4:MRI diagnosis distribution of the studied group

MRI diagnosis	No.	%
Clear bed	13	65
Residual	7	35
Total	20	100

This table showed that the clear bed was 65%) and residual was 35% of MRI diagnosis.

Table 5: histopathological diagnosis distribution of the studied group

Histopathological diagnosis	No.	%
Negative	13	65
Positive	7	35
Total	20	100

This table showed that the negative was 65% and positive was 35% of histopathological diagnosis.

Table 6: DWI distribution of the studied group

DWI	No.	%
Facilitated	13	65
Restricted	7	35
Total	20	100

This table showed that the facilitated was 65% and restricted was 35% of DWI.

Table 7: ADC distribution of the studied group

ADC	No.	%
High	13	65
Low	7	35
Total	20	100
ADC value x (10^-3) Range [Mean±SD]	0.67-1.83 [1.38±0.43]	

This table showed the high (65%) and low (35%) values of ADC; ADC value ranged 0.67-1.83 and mean 1.38±0.43

Table 8: the relation between histopathological diagnosis and demographic data

	Demographic Data	Histopathological diagnosis		t/x2#	p-value
		Negative (N=13)	Positive (N=7)		
Sex	Female Male	4 (30.8%) 9 (69.2%)	3 (42.9%) 4 (57.1%)	0.292#	0.589
Age (years)	Mean±SD Range	50.15±9.49 32-67	54.00±14.57 32-75	0.515	0.482

This table showed no statistically significant difference between positive and negative histopathological diagnosis according to demographic data.

Table 9: the relation between histopathological diagnosis according to T1, T2 and dynamic enhancement.

		Histopathological diagnosis		x2	p-value
		Negative (N=13)	Positive (N=7)		
T1	Hypo Isodense	13 (100.0%) 0 (0.0%)	5 (71.4%) 2 (28.6%)	4.127	0.042
T2	Hyper Hypo Intermediate	0 (0.0%) 13 (100.0%) 0 (0.0%)	5 (71.4%) 0 (0.0%) 2 (28.6%)	20.000	<0.001
Dynamic Enhancement	Enhancement Unenhancement	0 (0.0%) 13 (100.0%)	7 (100.0%) 0 (0.0%)	20.000	<0.001

This table showed statistically significant difference between positive and negative histopathological diagnosis according to T1, T2 and dynamic enhancement.

Table 10: relation between histopathological diagnosis according to MRI diagnosis

MRI diagnosis	Histopathological diagnosis		x2	p-value
	Negative (N=13)	Positive (N=7)		
Clear bed	13 (100.0%)	0 (0.0%)	20.000	<0.001
Residual	0 (0.0%)	7 (100.0%)		

This table showed highly statistically significant difference between positive and negative histopathological diagnosis according to MRI diagnosis.

Table 11: the relation between histopathological diagnosis according to DWI and ADC

	Histopathological diagnosis		x2	p-value
	Negative (N=13)	Positive (N=7)		
DWI				
Facilitated	13 (100.0%)	0 (0.0%)	20.000	<0.001
Restricted	0 (0.0%)	7 (100.0%)		
ADC				
High	13 (100%)	0 (0.0%)	12.913	<0.001
Low	0 (0.0%)	7 (100%)		

This table showed highly statistically significant difference between positive and negative histopathological diagnosis according to DWI and ADC.

Table 12**: the relation between histopathological diagnosis according to ADC value**

ADC value x (10^-3)	Histopathological diagnosis		t-test	p-value
	Negative (N=13)	Positive (N=7)		
Mean±SD	1.68±0.09	0.92±0.09	42.984	<0.001
Range	1.24-1.83	0.67-1.31		

This table showed highly statistically significant difference between positive and negative histopathological diagnosis according to ADC value.

Table 13**: diagnostic performance of ADC value in discrimination of positive and negative histopathological diagnosis.**

Cut-off	Sen.	Spe.	PPV	NPV	Accuracy
≤1.24	85.7%	92.3%	85.7%	92.3%	94.9%

Receiver operating characteristics (ROC) curve was used to define the best cut off value of:

- **ADC value**: was ≤1.24, with sensitivity of 85.7% specificity of 92.3% positive predictive value of 85.7%, negative predictive value of 92.3% with diagnostic accuracy of 94.9%.

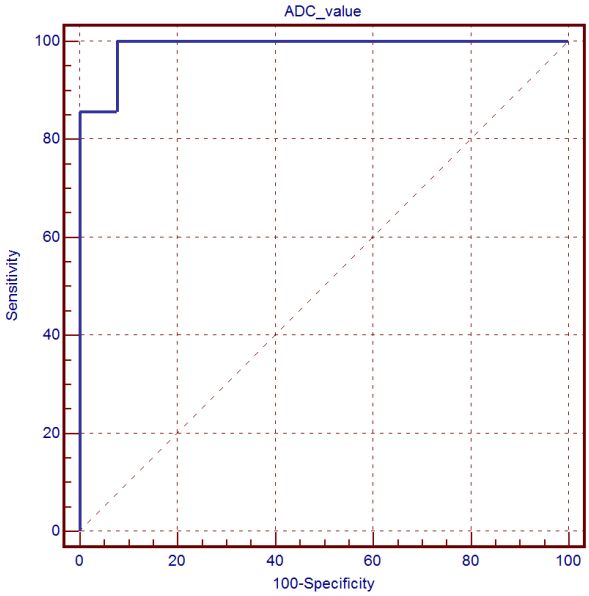

Figure 1: receiver-operating characteristic (ROC) curve for prediction of positive ADC value.

CASE PRESENTATION

CASE 1

Clinical history

A 49 years old female patient operated on for rectal carcinoma receiving chemotherapy underwent MRI examination for follow up.

Technique of examination:

-Axial T1 WI. Axial T2 WI
- Sagittal T2WI
- Post Gadolinium DTPA Axial
-Axial DWI and ADC map.

Pathological diagnosis:

Adenocarcinoma grade II.

Findings

The views were obtained by using axial T1WI , axial T2WI, sagittal T2WI, post gadolinium DTPA axial, axial DWI and ADC map. MRI examination revealed sizable soft lesion at the operative bed posteriorly at the presacral area more inclined to the left, measuring about 3x7x6.3cm in its maximum orthogonal plane. this mass is seen infiltrating the lower most portion of presacral fascia & left levator ani, left iliococcygeal muscle. Anteriorly the mass is seen infiltrating the cervix and posterior upper vagina with component seen protruding into the vaginal canal as shown in **figure 2 (A, B, C, D, E, F)**.

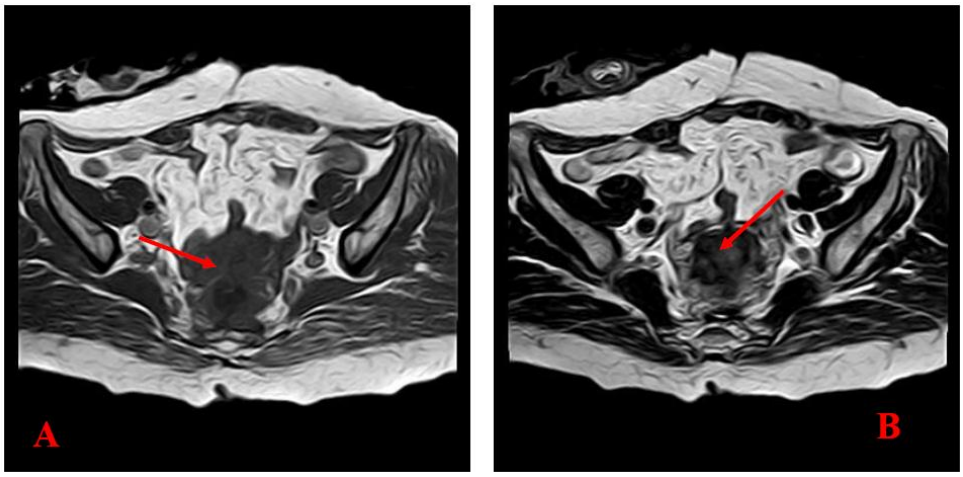

Figure 2 (A, B): A- Axial T1WI shows low signal intensity mass . B- Axial T2WI shows an intermediate signal intensity mass.

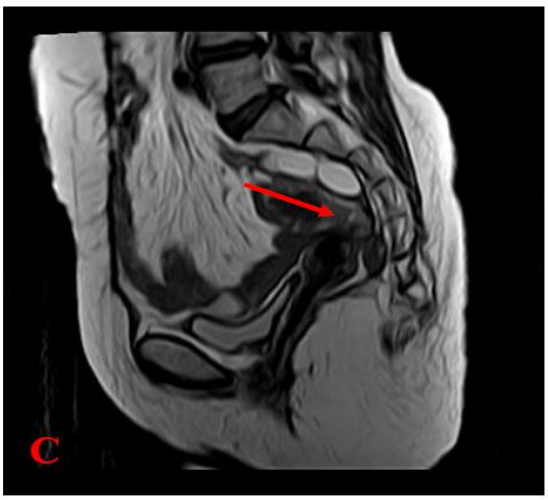

Figure 2 -C: sagittal T2WI shows intermediate signal intensity mass .

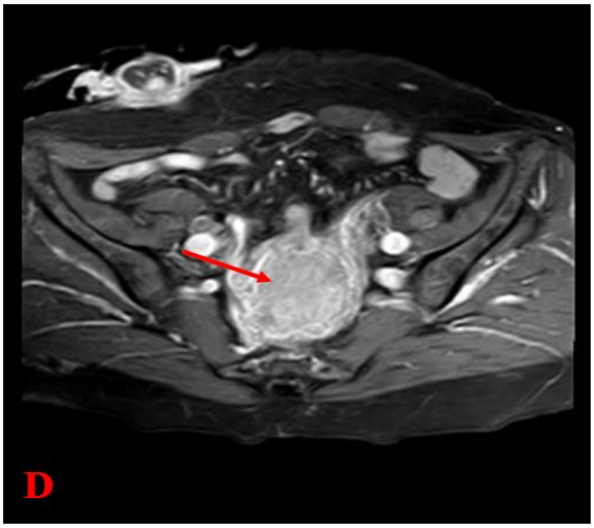

Figure 2 -D: post gadolinium DTPA axial shows post contrast enhancement mass.

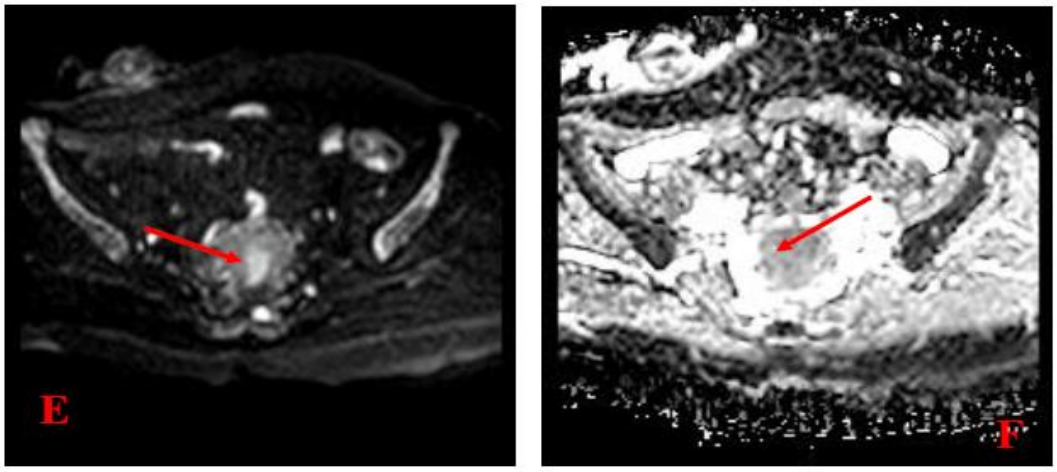

Figure 2-E, F: E- Axial DWI shows restricted pattern, F- ADC map shows low signal intensity with ADC value 0.85 x 10^{-3} mm^2/sec.

CASE 2

Clinical history

A 32 years old male patient operated on for rectal carcinoma receiving chemotherapy underwent MRI examination for follow up.

Technique of examination

-Axial T1 WI. Axial T2 WI
- Sagittal T2WI.
- Post Gadolinium DTPA Sagittal.
-Axial DWI and ADC map.

Pathological diagnosis

Adenocarcinoma grade III

FINDINGS

The views were obtained by using Axial T1WI, Axial T2WI, Post gadolinium DTPA T1WI sagittal, sagittal T2WI, axial DWI and ADC map. MRI examination revealed An ill defined soft tissue mass (about 3.5 x4 cm) seen at the operative bed infiltrating the posterior wall and the trigone of the urinary bladder resulting in irregular thickening and mass formation protruding into the urinary bladder lumen more inclined to the right .This mass is seen inseparable from the prostate with possible seminal vesicle infiltration as shown in **figure 3 (A, B, C, D, E, F)**.

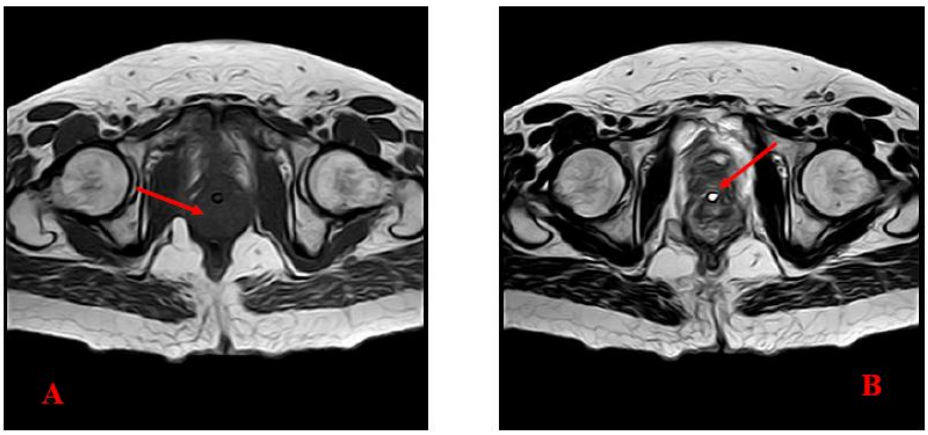

Figure 3 A, B: A- Axial T1WI shows low signal intensity mass , B- Axial T2WI shows an hyper signal intensity mass.

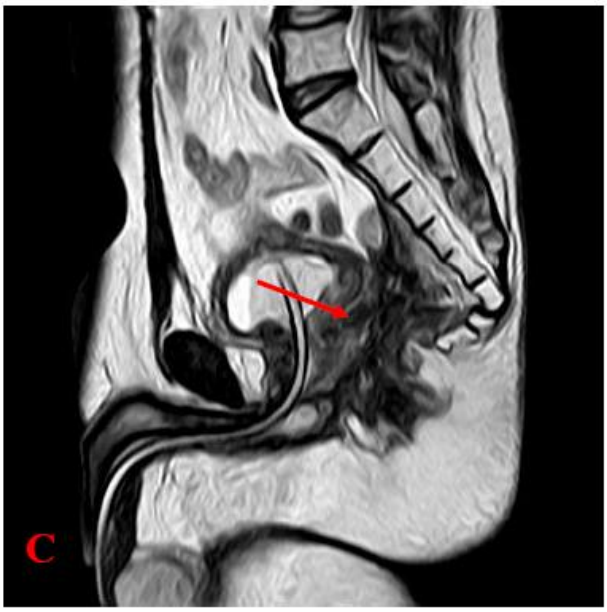

Figure 3 C: sagittal T2WI shows hyper signal intensity mass.

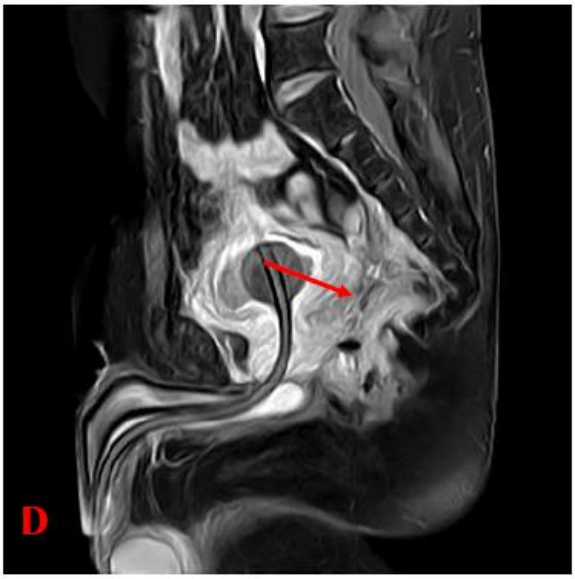

Figure 3 -D: post gadolinium DTPA sagittal shows post contrast enhancement mass

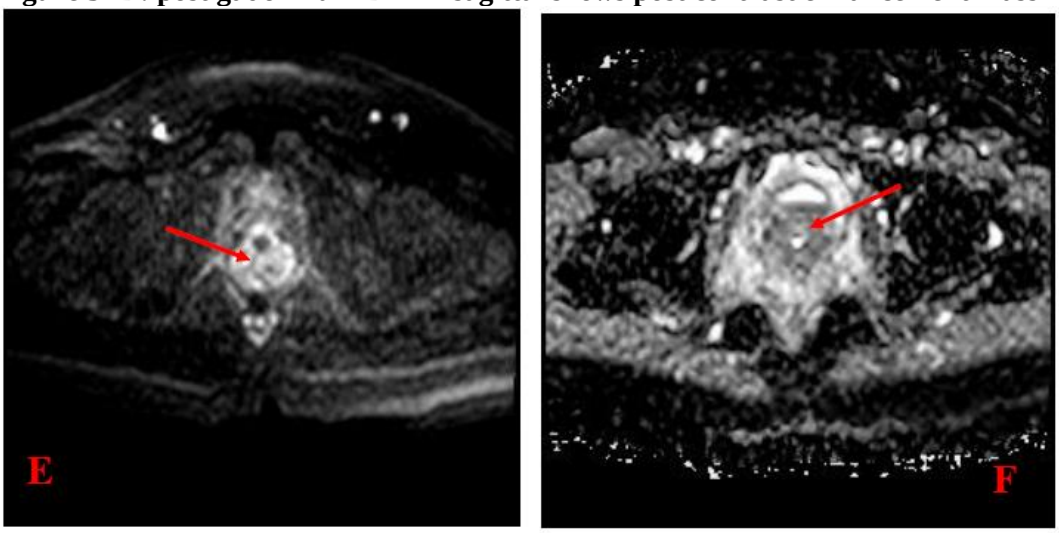

Figure 3 -E, F: E- Axial DWI shows restricted pattern, F- ADC map shows low signal intensity with ADC value 0,83 x 10^{-3} mm^2/sec.

CASE 3

Clinical history

A 67 years old female patient operated on for rectal carcinoma. She received chemotherapy and radiotherapy underwent MRI examination for follow up.

Technique of examination

-Axial T1 WI. Axial T2 WI
-- Sagittal T2 WI
-Post Gadolinium DTPA sagittal.
-Axial DWI and ADC map.

Pathological diagnosis

Malignant melanoma and adenocarcinoma GII

FINDINGS

The views were obtained by using Axial T1WI , Axial T2WI, Sagittal T2 WI, Post Gadolinium DTPA T1WI Sagittal , DWI and ADC map. MRI examination revealed recurrent mass seen of a soft tissue lesion measuring 5.6 x 3.6 cm in the left hemipelvis inseparable from the left aspect of the rectum with solid and cystic components of high mucinous/ haemorragic content as shown in **figure 4 (A, B, C, D, E, F).**

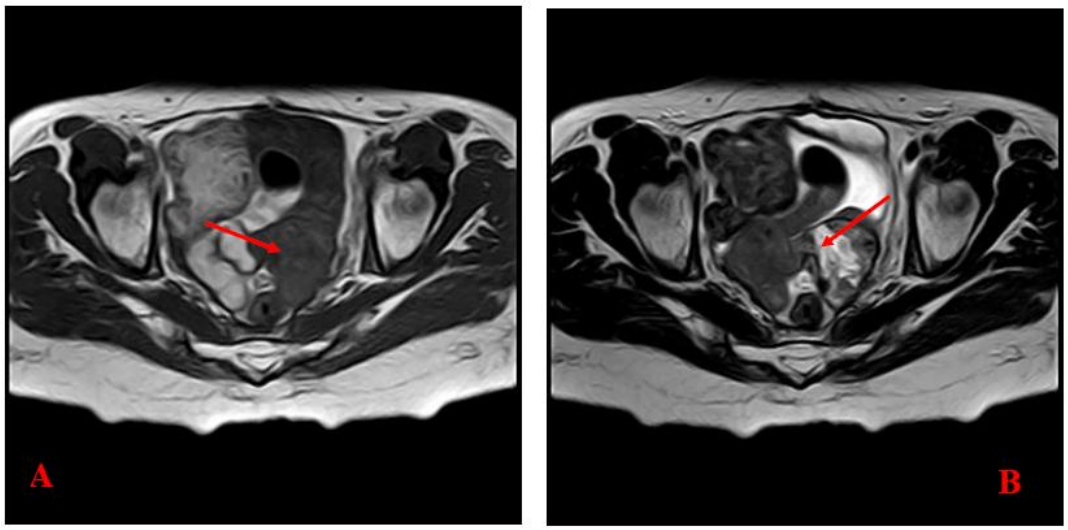

Figure 4 -A, B: A- Axial T1WI shows low signal intensity mass , B- Axial T2WI shows an hyperintense signal intensity mass.

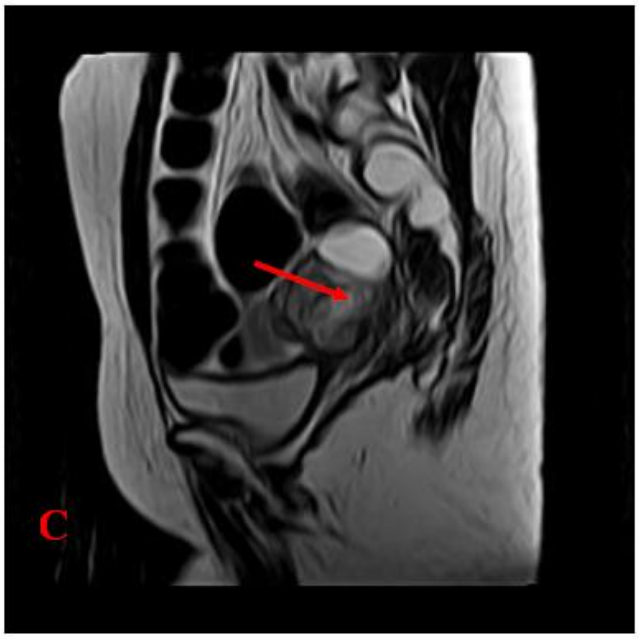

Figure 4 -C: sagittal T2WI shows an hyper intense signal intensity mass.

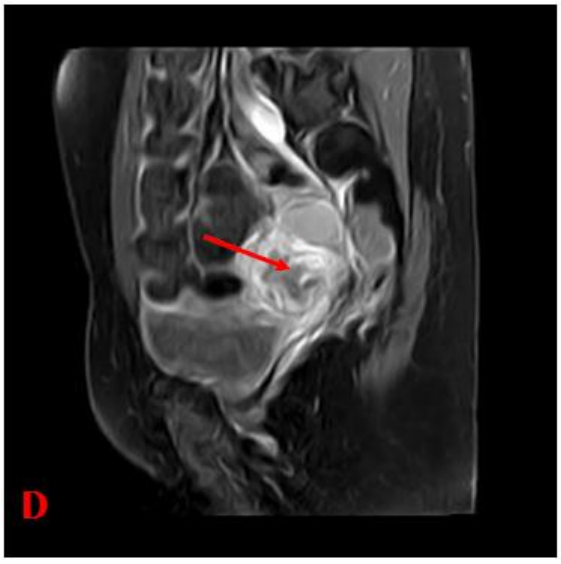

Figure 4 D: post gadolinium DTPA sagittal shows heterogeneous post contrast enhancement mass.

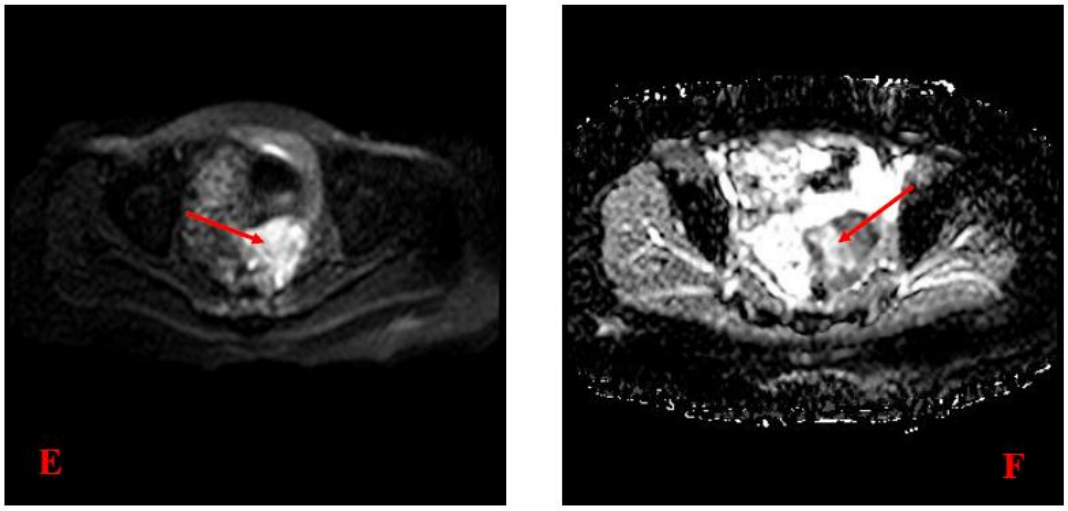

Figure 4 -E, F: E- Axial DWI shows restricted pattern, F- ADC map shows low signal intensity with ADC value 0.75 x 10^{-3} mm^2/sec.

DISCUSSION

Excluding skin cancers, rectal cancer is the third most common cancer diagnosed in both men and women in the United States. It accounts for a large number of tumor related deaths and recurrence occurs in about one-third of patients within the first 2 years after surgery [(7)]. Operative management of cancer rectum has been refined significantly during the past 20 years. The main advance has been the specialization and standardization of mesorectal excision, pathological involvement of the circumferential resection margin (CRM) and/or an incomplete mesorectum excision are predictors of local recurrence [(2)].

American Cancer Society, considered that the survival of the patients with rectal cancer depends to a large extent on the stage of the disease at diagnosis. Thus, inpatient with localized disease, 5years survival is approximately 60%. On the other hand, patients with distant metastasis have 5 years survival rate less than 10% [(8)]. Survival is directly related to the extent of the extra mural spread into the mesorectum and the ability to achieve surgical clearance at the circumferential resection margins. Two modalities in therapy are considered to have a substantial effect on reducing the frequency of local recurrence and improving survival: total mesorectal excision surgery and preoperative neo adjuvant radiation therapy and chemotherapy. Preoperative radiation therapy was found to result in down staging and cause the primary tumor to shrink, permitting sphincter preserving surgery and avoidance of colostomy [(9)].

Early detection of recurrent rectal carcinoma has become more important in the past decade as the treatment options for localized disease have been improved significantly. Therefore detection of tumor sites throughout the body is needed with high sensitivity and specificity [(10).] In the follow-up of rectal carcinoma, the clinically relevant questions to be answered include: where are the potentially malignant tissues localized, is a specific lesion malignant or not and what is the local extent of a specific lesion? An important role of imaging is to guide the rational use of invasive diagnostic procedures and to guide loco-regional therapy [(10).] In this study, we had focused on the evaluation of the role of MRI in assessment of the post-operative pelvic changes and complications as well as detection of recurrence in cancer rectum patients.

This study was carried out on 20 patients who underwent surgical resection of primary rectal cancer using phased array surface coil; as this type of coils yields high spatial resolution images and overcome the problems that we meet with endorectal coil or endo- luminal besides the large field of view with the surface coil compared to endo rectal coil or endo luminal**.**

Lambregts *et al.* [(11)] described that the adequate MR sequence technique to adequately interpret the images and provided the necessary information for detection of recurrent tumor tissue. The standard rectal MRI protocol consisted of 2D T2-weighted (T2W) fast spin-echo (FSE) sequences in three planes; sagittal, axial and coronal , DWI sequence had been implemented as part of the standard rectal MRI protocol. The DWI sequence was an axial diffusion-weighted sequence with background body signal suppression. The axial T2-weighted and DWI sequences were obtained in identical

planes. After abdomino- perineal resection or extended resection there is no remaining rectal lumen to obtain the axial sequences. So, axial sequences obtained by angling perpendicular to the interface between the local area of suspicion and the closest structure or organ.

Results of **Lambregts *et al.* [11] and Hoeffel *et al.* [12]** agreed with our study in that using pelvic MRI is highly effective modality in postoperative evaluation of patients with anorectal carcinoma and has a high accuracy for the diagnosis of locally recurrent rectal carcinoma. Familiarity with the normal postoperative anatomy of the different commonly used surgical procedures as well as the usual patterns of postoperative complications and recurrence increase the effectiveness for accurate interpretation of MR images obtained during the postsurgical period or at follow-up [12].

In our study, the specificity , sensitivity and accuracy were about 85.7% , 92,3% , 94.9 % respectively which showed no significant changes from results of **Lambregets *et al.* [12]** since specificity was 91 % , sensitivity was 100 % and accuracy was 95 % and **Sinaei *et al.* [13]** (Sensitivity 90% and specificity was 100% ,accuracy was 96 %). **Colosio *et al.*[5]** (Accuracy up to 99 % , sensitivity up to 100 % and specificity up to 86 %**)** **Grosu *et al.* [14]** (Sensitivity 93% and specificity was 91%, accuracy 92 %).

In our study we depend mainly on the morphological appearance, post contrast enhancement pattern of the detected mass and diffusion pattern and its ADC value for diagnosis of recurrence confirmed by histopathological examination. **Keyzer *et al.*[15]** agreed with our study that the morphological information reported from MRI and the functional information from DWI are highly beneficial in the diagnosis of recurrent tumor growth.

Results of **Torricelli *et al.* [16]** are in agreement with our results in that use of dynamic contrast enhancement (DCE) Gadolinium sequences helpful for better diagnosis of recurrent tumor.

Dresen *et al.* [17] found that contrast enhancement greater than 40% of the volume of a mass or a typical rim-enhancement pattern after gadolinium contrast material administration were highly sufficient accurate criteria for differentiation between recurrent tumor and fibrosis.

Result **Kim *et al.* [18]** is agree with our study in that use of DW-MRI is highly valuable as it clearly discriminates the abnormal signal intensity of tumor from surrounding organs such as the bowel or from fibrosis as they found that the main limitation of the MRI generally is overestimation of the presence of tumor within areas of postoperative fibrotic scar tissue.

We found that pelvic MRI is highly valuable and accurate in postoperative assessment of surgical complications and follow up for detection of residual or recurrent tumor tissue and presence or absence of tumor invasion in pelvic structures which provide a road map for the proper surgical planning and treatment of the patients which highly affects survival rates. This conclusion agrees with results of **Colosio *et al.* [5]** who stated that pelvic MRI is accurate not only for detection of pelvic rectal recurrence but also follow-up LR treated with radiofrequency ablation. MRI is more valuable than PET-CT for detection of recurrence and may surpass the accuracy of PET-CT in patient examined for detection of recurrence as it overcomes the limitations of the PET-CT which due to limited spatial resolution relative to MRI , poor FDG uptake of recurrent mucinous adenocarcinomas and patients with associated sepsis or anastomotic leakage or postoperative inflammation .Also , physiological uptake from displaced organs in case of distorted postoperative anatomy, and patients receiving chemotherapy when tumor tissue is not metabolically active might lead to false positive interpretation . Finally PET-CT is high cost and not usually available relative to MRI. The future of detection of recurrence of rectal carcinoma by MRI should be targeted towards making studies on larger population suffering from this disease to get more satisfying results and towards raising the MRI sensitivity and specificity in detection of recurrence or residual malignant tissue.

CONCLUSION

Our results demonstrated that MRI has pivotal role in accurate post-operative assessment and detection of recurrence in cancer rectum patient .Thus we conclude that post-operative MRI has a golden standard value not only for follow up post-operative complication and detection of recurrent rectal carcinoma but also helps to predict suitability for curative surgery and assist informed decisions on palliative resection which highly affects survival rate.

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